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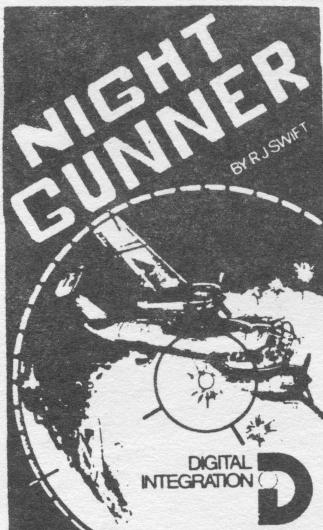
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TRAVELS WITH TRASHMAN (The sequel to the above) -- Your mission is to go forth into the world and throw away all the trash. Quite a few places of interest can be visited, Germany, Hong Kong, France, Israel, Spain, Samoa, and of course America - lots of action and good graphics - challenging and every bit as good as TRASHMAN, also, joystick controlled (or keyboard). \$ 11.95

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TIME DESIGNS

Volume 2, Issue 1

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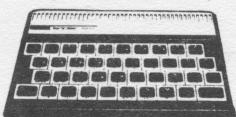
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Editor's Corner

Early in September of 1984, we decided to call our new T/S computer magazine "TIME DESIGNS" for several reasons. One of those reasons was not because of TIMEX (as the "X" has obviously been dropped). At this same time, many users groups had changed their name to SINCLAIR/TIMEX (instead of the reverse), due to their bitter disappointment in that company. One associate of mine even peeled off the nameplate sticker on his 2068 and cut out the Timex name, replacing only the "Sinclair 2068" part.

Instead, "TIME" refers to our belief that T/S machines will be around for a long "time". They are "timeless" (if you prefer) as their technology has in no way been outdated. I still feel the "one-key" command system is far superior to anything else that I have used.

The "DESIGNS" part stems from our fondness for Uncle Clive's computer "designs"... the ZX-81, 2068, Spectrum, and now the QL. "Designs" also is a reflection of our intrigue of computer-generated graphics. You may have noticed we feature a lot of graphics in the magazine.

Welcome to Vol. 2 No. 1, our First Anniversary Issue. Before I wrap this up, I wish to express my gratitude. First, to you our loyal readers. In just one year, TIME DESIGNS has grown to be one of the largest Timex/Sinclair publications in America. If those first few subscribers hadn't realized our potential and sent in their subscription orders [you know who you are], we probably wouldn't be around today.

Also, I wish to thank our contributors who have sent in their excellent materials to be published this last year. And special appreciation and thanks to our loyal and dedicated advertisers also. Without them our T/S community would be non-existent.

In closing, as editor of this magazine, I would like to say that over the next year, I promise to keep up-grading our content and appearance...and that TIME DESIGNS will continue to be published. See you next issue (in 1986)!



LETTERS

Direct all correspondence to: The Editor c/o Time Designs
29722 Hult Rd., Colton, OR 97017

"I am attempting to build my own interface from the 2068 to any popular printer, for example, Epson or others. I would like to know if this subject has been addressed in prior issues. If not, would it be possible to request thru a user's column, some assistance from any of your readers who perhaps have already 'dabbled' in this area. My interest in computers leans toward 'do it yourself construction', and thus my request. Thank you for your help."

Robert E. Kern
Rialto, CA

[Editor: Some may say that we have been rather "skimpy" in the area of construction projects. I vote for change right now...this has been one of the most requested columns lately. Anyone out there who wired up their own printer interface, who can assist Mr. Kern?]

"Accolades for you! Sept/Oct '85 edition of TIME DESIGNS was the best ever...I'd like to hear more about the 128k Spectrum. The single-key commands of Sinclair BASIC are not used on the QL (I understand). Maybe the attraction of the Spectrum has been the use of the command key system. I have no desire for a QL because of the change. I wonder how many others feel the same way. I also wonder how many new 2068 and 1500's there are left with dealers? Keep up the fine work."

Joan Kealy
El Paso, TX



AUTO-PORTRAIT

Thanks goes to A. Laviolette of Montreal, Canada for sending his two drawings that were made using the program PABLO PIXEL-O (ZX-81 version), featured in the Sept./Oct. issue of TIME DESIGNS.

"I have now received the first two issues (#5 & #6) of my subscription, and I want to congratulate you for a very fine magazine. Many of us are first time users, and self-taught, and far from any known user groups; so the arrival of each issue is an eagerly anticipated event. The suggestion submitted by Mr. Russell Ochoki to publish a column of programming tips and useful short programs certainly receives my endorsement. I would be particularly interested in the use of system calls. (I have tried in vain to obtain a copy of the T/S 2068 Technical Manual.) For example, it took me quite some time to figure out how to BEEP from machine language. (SOUND was easy.) I am happy to share the following listing. I hope that other readers will find it serviceable.

```

00395 BEEP    LD BC,60
00400          LD D,B
00405          LD H,D
00410          LD A,(TIME)
00415          LD E,A
00420          LD A,(TONE)
00425          LD L,A
00430          BIT 7,A
00435          JR Z,TUNE
00440          DEC H
00445 TUNE    ADD HL,BC
00450          PUSH BC
00455          PUSH HL
00460          PUSH DE
00465          CALL 12521
00470          POP BC
00475          CALL 12521
00480          RST 40
00485          DEFB 1,5,56
00490          POP BC
00495          CALL 12521
00500          POP BC
00505          CALL 12521
00510          RST 40
00515          DEFB 3,56
00520          CALL 1078
00525          RET
00530 TIME    DEFB 5 ;60ths
00535 TONE    DEFB 10

```

All numbers are decimal. The value in (TIME) is in 60ths of a second, so that the longest note you can play with this routine is 4.25 seconds (255/60). Also the restrictions on (TONE) are the same as in the USER MANUAL: This value must be in the range -60 (156) to 69. Numbers 70 to 155 will return report code B.

A typical call of this subroutine may look like this!

```

;BEEP .1.12
LD A,5
LD (TIME),A
RLCA
LD (TONE),A
CALL BEEP

```

Before signing off, I would like to thank Michael E. Carver for making his PABLO PIXEL 0 as instructive as possible...I'm already looking forward to issue no. 7!"

Ron Ruegg
Baton Rouge, LA

[Editor: Well Ron here is issue no. 7 or Vol. 2 No. 1 to be exact...and its a pleasure to include you as a part of it. Thanks for the listing, I hope that it inspires others to send in their short programs and tips.]



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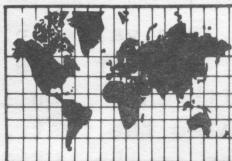
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SINCLAIR NEWS NETWORK

U.S. QL - \$299

Sinclair's 32-bit micro, the QL, now has a suggested retail sticker of \$299 U.S. dollars. Not only is it much more affordable but also easier to obtain. In a generous gesture, Nigel Searle of Sinclair Research has offered the QL with incentives to T/S dealers here in the States. At this writing, seven companies have contacted TIME DESIGNS to announce that they will be handling the \$299 QL. They are: Curry Computer, EMC (The English Micro Connection), Knighted Computers, Ramex International, RMG Enterprises, Sunset Electronics, and Zebra System, Inc.

The new QL price tag is a follow-up to the half price cut in Europe last September. Sinclair is preparing for what could be a "make-or-break" Christmas selling season in Great Britain.

While the QL emerged upon the home computer market with flair, it has been moving slowly in sales. Sinclair claims that the new price reduction is a result of reduced manufacturing costs, and major savings from a substantial increase in manufacturing volume (based on current sales "commitments"). Industry-watchers noted that the QL price cut came three days after the announced release of a competitor's new computer...the Amstrad PCW8526.

Sinclair Research Ltd., is still on its feet for the time being, following the major debt rescheduling with Barclays Bank and other creditors. Sub-contractors Thorn EMI, Timex Corp. and AB Electronic Products were all agreeable to the terms. These companies assemble Sinclair's computers in contracted factories. Sir Clive, who's lack of management skills have been well-publicized, has placed a new management team in control of Sinclair Research's future direction.

The QL with its \$299 (complete) price should move quite a few units here in the States. A lot of new software is available from the U.K. presently, with hundreds of new titles currently being developed. Sinclair has just authorized the production of a new floppy disc system (3 inch drives), that should be out sometime early next year.

128k SPECTRUM

The Sinclair 128k Spectrum is no longer rumor, but fact. In September at a home computer and electronics show in London, Sinclair unveiled their new machine, the last few days of the show. Surprisingly, the 128k Spectrum resembles the T/S 2068 except for the QL-type black case. It utilizes the 2068 bank-switching, three video modes, three-channel sound chip, and built-in joystick ports. Reportedly it is 100% compatible with all software for older Spectrum models.

As we went to press, the 128k Spectrum was already available in Spain. However, it is expected to be in the English shops after the first of the year. A spokesperson for Sinclair (U.S.) told TIME DESIGNS that there are no plans to market the 128k Spectrum in America. Although Bob Dyl of the English Micro Connection announced plans to carry it, when supplies are made available.

POCKET TV PERFORMS WELL

The new Sinclair Pocket TV is truly an amazing piece of high-technology. Last week, TIME DESIGNS obtained a sample unit for review from Sinclair Research. The Pocket TV is a compact little unit (5 1/2" x 3 1/2" x 1 1/4") with a black plastic case. It utilizes circuit miniaturization extensively. It is powered by Polaroid's unique 6v (flat) Lithium battery. This battery is rated for 15 hours (total) life. However, an external DC supply jack is also provided. The Pocket TV comes complete with a tiny earphone (for optional private listening), and a smartly-styled velvetine carrying pouch. Suggested retail price is \$100.

Unlike most standard TV's, where the picture image is "shot" from the rear of the set to the front screen surface, the Pocket TV's screen is absolutely "flat", and the viewer peers in at the screen thru a plastic fresnel lens. The viewing area is approx. 1 and 1/2 x 1 inch. The Pocket TV is tuned by turning a small thumb-wheel (moving a



needle across a calibrated dial). VHF and UHF are selected by a switch. The built-in 18 1/2" telescoping antenna pulls the TV stations in.

In a side-by-side comparison test with the Sony Watchman, the Sinclair Pocket TV picture clarity was just as good, if not a little better. Not to mention that the Sony retails for twice the price of a Sinclair. The Pocket TV received every available VHF and UHF station in the high-signal strength area. When tested in the "fringe" area, it demonstrated good sensitivity, pulling in about half of the available stations...with fairly decent reception. The volume control on the unit can be adjusted from quiet to surprisingly loud levels.

If you would like to own one of Sir Clive's latest electronic wonders, this is certainly a "conversation" piece. Some practical uses for the TV are possible such as private home viewing, camping, or sports events. If interested, some T/S dealers have the Sinclair Pocket TV available.

PRODUCT NEWS

BNF Enterprises, 119 Foster St, PO Box 3357, Peabody, MA 01961, (617) 531-5774, has several T/S 2040 printers for \$38.88 each.

RAMEX has a new address: 17620 26 Mile Rd., Washington, MI 48094, (313) 781-5800. They are offering the MK Floppy Drive System only as a "package" deal for \$400 (includes one quad-density drive, SP-DOS interface, cables, and three software discs including Tasword, Masterfile, and Omni-calc). They have discontinued selling the interface separate, to eliminate problems of buyers using their own incompatible drives, a spokesman from Ramex told TIME DESIGNS. They also have another floppy drive "package" system with dual 3 inch drives and the SP-DOS interface

for \$299 (no software included). Ramex is a QL dealer, and includes a ROM cartridge called "ICE" (Icon Controlled Environment), \$99 value, but free to purchasers of the \$299 QL. ICE turns the QL into a Mac-like computer.

Group Technology, Ltd., POB 87, Check, VA 24072, (703) 651-3153, has T/S books and h/w for interfacing external devices to the ZX-81 and 2068.

Zebra Systems, Inc., 78-06 Jamaica Ave, Woodhaven, NY 11421, (718) 296-2385, is a company that has supported T/S computers since the ZX-81. They have recently affirmed their continued support by releasing several new products for the 2068. In stock now are the Zebra Disk Drive Systems (from Portugal) for \$349.95. Also in stock is the brand new OS-64 Operating System Cartridge, that enhances the 64 col. video mode of the 2068. 64 col. feature works on screen, or sent to a full-size printer. Price is \$29.95. There are some new software titles available, including the "Greeting Card Designer" (which is like Atari's Print Shop). Card Designer prints cards of your own design on a full size printer. Many of Zebra's new programs are available on 3 inch discs. Card Designer is in stock for \$19.95 (cassette) and \$24.95 (disc). For total order include \$3.00. Along with their catalog for the 2068 and 1000, they have a QL s/w and h/w catalog available to support the \$299 QL (yours, just for the asking!).

Small Digital Systems, Inc. have two utilities that improve the Hunter 8k RAM Board for the T/S 1000. They are the Memory One and REMC, for \$14.99 each. For more information, write to SDS, c/o Product Info Services, 2089 Chatsworth Blvd, Suite 4, San Diego, CA 92107, or phone (619) 569-2743.

The English Micro Connection just put their new 36 page Sept.-Dec. catalog in the mail. Considerably larger and professionally printed, it lists a wide variety of English computer products for the Sinclair Spectrum. All of the s/w and h/w has been tested by EMC for 100% compatibility with the T/S 2068 (modified with some form of Spectrum emulation). The catalog contains lots of photos and descriptions for reference. If you are not on their mailing list, write to them at 15 Kilburn Ct., Newport, RI 02840, or phone (401) 849-3805.

DAMCO Enterprises is having a special Holiday sale. The Wafadrive system for the 2068 (complete with their new Rainbow plus Spectrum Interface) is priced for a limited



time at \$175 plus \$5 S&H. They also have several Spectrum software package deals (on cassette). For example, a grab bag of three titles may contain one or more of these titles: Chess, Dungeon Master, Traxx, Ship of Doom, ect. The price? \$9.95. There are many more deals including educational software. If interested, contact DAMCO at: 67 Bradley Ct., Fall River, MA 02720, or phone (617) 678-2110.

Kurt A. Casby, 25 Battle Creek Ct., St. Paul, MN 55119, has written a utility program for Westridge's MTERM modem software. It expands MTERM's buffer to allow the user to load up long text files from Tasword. The program also adds further capabilities to the auto-dial (and macro key) section. For more information and pricing/dealers, write to Mr. Casby at the address above.

A new company from "up north", Beaver Computer Products, has two software titles available for the 2068. "Character Font Generator" aides the user in designing custom character sets or UDG's, and is priced at \$25. "Advanced Video Modes" is a utility for 2068's dual screen, extended color, and 64 column modes. It is priced at \$15. All software prices are quoted in Canadian funds. Postage and handling is free. Write to: 999 Munroe Ave, Winnipeg, Manitoba, R2K 1J4.

MISC.

Carver Technologies is a division of T/S Connection. They will repair Timex/Sinclair computers for a nominal fee. However, they are not an authorized warranty repair outlet. All warranty repairs should be sent to Timex in Little Rock, Arkansas. Carver Technologies have developed some enhancements for T/S products such as a stereo jack for the 2068, LED power indicator for the 2068, and a power supply switch for the 2040 printer. For information on service rates and add-on modifications, write to: The T/S Connection, 3832 Watterson Ave., Cincinnati, OH 45227.

The Greater Cincinnati Users Group has developed a 2068-based BBS which is now operational. It will become fully-operational on a nation wide basis in a few weeks with the addition of an Aerco Disk Drive System. A Mr. Jack Roberts c/o The T/S Connection has more details on the BBS.

A Midwest ZX/TS Computer Fair is in the planning stages. Mr. Frank Davis, 513 East

Main St, Peru, IN 46970, would appreciate any reader input or suggestions. His phone number is (317) 473-4885. Compuserve I.D. is 75525,1325. The Computer Fair is scheduled for this next spring.

USERS GROUP UPDATE

If your Timex/Sinclair Users Group hasn't been listed in TIME DESIGNS before, such as the directory in the March/April 85 issue, or an update...please send us the information so that we can mention you. We have added new members to groups because of this listing. Here are some additional ones to add to your list:

Dallas Timex Sinclair User Group
2624 E. Park Blvd.
Plano, TX 75074
Contact: Julie Barrett

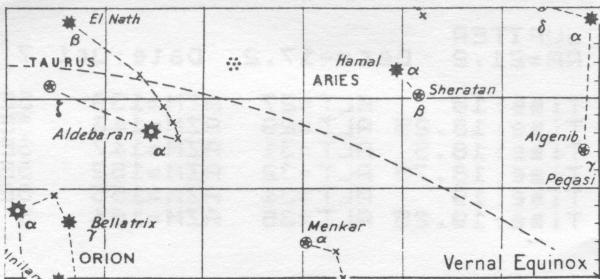
Omaha Timex/Sinclair User Group
2104 So. 35th Ave
Omaha, NE 68105
Contact: Dan Hargens (Secretary)
Group would like to contact other
groups for purpose of trading info.

PC Users Group Of New York
(formerly ZX Users Group of NY)
Box 560-Wall St.
New York, NY 10005
Publishes PC World News Bulletin
\$15/year for membership/subscription

Mexican Timex/Sinclair User Group
c/o M. Adriana Rodriguez Maldonado
Tlaloc #21, Col. Tlaxpana
C.P. 11370
Mexico, D.F.

ERRATUM

There were a few typos in the article "Adventures In The Ram Jungle (Part One)" in the Sept./Oct.'85 issue: Page 14, Col. 2, Line 23, should read 8191 (instead of 819). Page 15, Col. 1, Line 19, should read "Initialization" (instead of "Itialization"). Page 15, Col. 1, Line 27, the colon at the end of program line 30, should be a semi-colon. Also, Jack Keene (3515 Ingleside Dr., Dallas, TX 75229) pointed out that the info supplied about his SWITCHBOARD (in the Spectrum Wares section) was incorrect. Instead of being installed in the cartridge dock, it is an internal modification similar to Bill Russell's ROMSWITCH.



Everyone enjoys looking at the stars on a starry night even when they do not consider themselves amateur astronomers. A standard pair of binoculars can reveal some breathtaking sights in the night sky. They can show Jupiter and between two and four of its moons...including the forbidden Europa 2010 fans! Jupiter is quite a sight all summer long. Halley's comet is coming and will be easy to spot in those same binoculars by November, if one knows where to look.

But if everyone feels as I do, the heavens can be a little confusing when it comes down to finding things. If one does not know the constellations, or has no idea where to look to find anything less obvious than the full moon, then I may have just the remedy. The 2068 can direct us, using the accompanying program listing.

Up until now, looking things up in an astronomical reference only provided some coordinates given as "Right Ascension" and "Declination" or "RA" and "Dec". These strange figures are for aiming telescopes accurately, but are generally meaningless to the casual observer. The 2068 can make sense out of most anything, and such is the case with RA and Dec. The computer can convert these values into an easier to follow set of horizontal and vertical coordinates called altitude and azimuth.

Altitude indicates the relative height in the sky being zero at the horizon and progressing to 90, directly over-head. Simple enough. Azimuth is just as easy. Remember a compass with north, east, south, and west? Azimuth follows the compass clockwise with zero as north, 90 as east, 180 as south, and so on to 360 (north again). Even if numbers zero to 360 are confusing, the program prints out the compass directions too.

The program spits out values by time of day for which compass direction (azimuth) to look and how high off the horizon (altitude) to look, to find just what we are searching for. By using any set of RA and Dec values



2068 GAZER'S GUIDE



by Paul Bingham

in an astronomy book or from magazines like ASTRONOMY or SKY AND TELESCOPE, we can easily find any object in the sky any time for any date. Our program and the 2068 handle all the calculating...all we do is look where it indicates and enjoy!

PROGRAM NOTES: The program is designed to be simple and straight forward. One can naturally alter it to suit one's taste, but lines 30 thru 115 are the program's core, and should be entered as is.

As the program listing stands now, "o" and "L" for longitude and latitude in line 5 are set for my location. Someone in the local library map room can help with these values if available nowhere else. The factor "k" in line 5 is set for 1985. Values for [the years] '86 thru '89 are: 6.6241, 6.6081, 6.5921, 6.6419 respectively. The value "v" is the time zone displacement. The west coast is 8, the east coast is 5, my zone in Arizona is 7.

RA and Dec are always listed in hours-minutes-seconds fashion. Rounding to the nearest hour value is generally accurate enough. The program will accept hour values with decimal input, if real accuracy is required. One must remember to enter a minus sign if one is listed with the RA or Dec value.

The 24 time system is required by the program. This is familiar to most everyone, but in case one is rusty...midnight is zero. The value increases by one, each hour thru noon (12). Then 1:00pm becomes 13 and so on to 11:00pm (23). Figure A for Jupiter will show that even fractions of the hour are accepted.

The program will indicate a minus altitude value for any object below the horizon. Objects near due south, or directly over-head sometimes give less accurate results until the object moves. The remainder of the program needs no explanation to run.

Of interest will be the table of RA and Dec values in Figure B for Halley's comet. These are given weekly thru June 1986. In case a test of the listing is desired, use the table in Figure C as a check.

Good-bye and Good Gazing! P.B.

Program Listing

```

1 REM RA/Dec to Alt/Azimuth
5 LET n=180: LET c=.99999: LE
T o=111.7: LET L=33.4: LET k=6.6
383: LET v=7: DIM C$(1,16): LET
C$(1) = "NEE SES SUU NUN": DIM M$(
1,72): LET M$(1) = "Jan 0Feb 31M
ar 59Apr 30May 12Jun 15Jul 181Au9
212Sep 243Oct 273Nov 304Dec 334"
10 INPUT "Object: "; N$: INPUT "
RA: "; R: INPUT "Dec: "; D
15 CLS : FOR t=1 TO 12: PRINT
t: : LET #=t: GO SUB 170: PRINT T
AB S; M$(1,# TO #+2): NEXT t: INP
UT "Month: "#: CLS : INPUT "Day:
": #=GO SUB 170: LET V=VAL M$(1,
#+3 TO #+5)+#: PRINT N$: PRINT "
RA="; R; TAB 9; "Dec="; D; TAB 20; "Da
te: "; M$(1,# TO #+2); " "; #"
20 INPUT "(0-24hr): "; U: LET U=
INT (U*100+.01)/100
30 LET T=k+.06574*U+1.0027*(U+V
)-(.015)
40 IF (T)>24 THEN LET T=T-24
50 LET H=(T-R)*15
60 LET Q=D/n*PI: LET F=L/n*PI
70 LET G=COS (D*PI/n): LET i=C
OS (L*PI/n): LET j=COS (H*PI/n)
80 LET A=(Q+F)+(G*i*j): IF A)=
1 THEN LET A=c
85 IF A=-1 THEN LET A=-c
90 LET A=(ASN A)*n/PI
100 LET Z=(Q-F*(INT A/n*PI))/(i
*n*COS (INT A*PI/n)): IF Z)=1 THEN
LET Z=c
105 IF Z<-1 THEN LET Z=-c
110 LET Z=(ACOS Z)*n/PI
115 IF H>360 OR H<0 AND H<n OR
H<-n AND H>-360 THEN GO SUB 130
130 PRINT "Time: "; U; TAB 11; "ALT
="; INT (A+.5); TAB 19; "AZM="; INT
(Z+.5)); IF Z<23 THEN LET Z=340
135 LET P=(INT ((Z-23)/45))*2+1
: PRINT TAB 29; C$(1,P); C$(1,1+P)
140 INPUT "1)COPY 2)RA 3)Day 4)
Hr 5)Quit "; P: IF P=5 THEN STOP
150 IF P=1 THEN COPY : GO TO 14
0
160 GO TO P*5
170 LET #=(#-1)*6+1: RETURN
180 LET Z=360-Z: RETURN

```

Figure C

Object	RA	Dec	Date	Time	ALT	AZM
w Galaxy Cluster 1656	13.5	-47.3	6/1	3	-26	222
Hercules Cluster M13	16.7	36.5	8/15	22	65	268
Whirlpool Galaxy M51	13.5	47.3	10/14	18	33	315
Dumbell Nebula M27	20.0	22.7	10/13	19	90	180
Eskimo Nebula 2392	7.2	21.0	12/7	1	68	165

JUPITER		RA=21.2	Dec=-17.2	Date: Oct 7
Time:	18	ALT=27	AZM=139	SE
Time:	18.25	ALT=29	AZM=143	SE
Time:	18.5	ALT=31	AZM=147	SE
Time:	18.75	ALT=32	AZM=152	SE
Time:	19	ALT=34	AZM=155	SE
Time:	19.25	ALT=35	AZM=164	S

Figure A

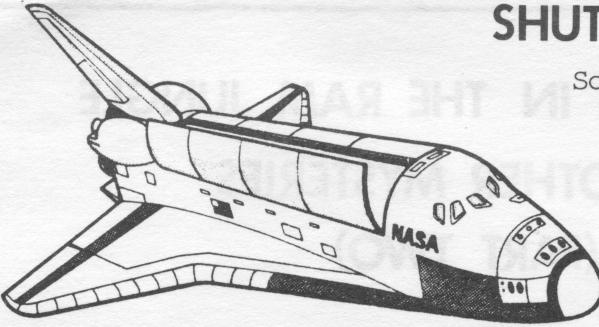
HALLEY'S COMET

date	RA	Dec
	h m s	° ' "
14- 9-85	6 12 41	+19 31 43
21- 9-85	6 13 16	+19 40 35
28- 9-85	6 12 27	+19 51 37
5-10-85	6 9 44	+20 05 45
12-10-85	6 4 23	+20 23 57
19-10-85	5 55 15	+20 47 08
26-10-85	5 40 35	+21 15 20
2-11-85	5 17 30	+21 45 19
9-11-85	4 41 42	+22 03 54
16-11-85	3 48 2	+21 33 38
23-11-85	2 35 55	+19 57 48
30-11-85	1 17 51	+14 21 30
7-12-85	0 12 4	+ 0 51 31
14-12-85	23 24	41 + 4 10 52
21-12-85	22 52	1 + 1 2 20
28-12-85	22 20	53 - 1 17 13
4- 1-86	22 11	31 - 3 0 54
11- 1-86	21 57	22 - 4 24 33
18- 1-86	21 44	46 - 5 39 36
25- 1-86	21 32	35 - 6 54 52
1- 2-86	21 20	9 - 8 17 18
8- 2-86	21 7	26 - 9 51 24
15- 2-86	20 54	31 - 11 36 48
22- 2-86	20 42	10 - 13 39 31
1- 3-86	20 30	11 - 15 56 43
8- 3-86	20 17	31 - 18 40 40
15- 3-86	20 1	56 - 22 12 4
22- 3-86	19 36	53 - 27 0 29
29- 3-86	18 57	0 - 34 30 28
5- 4-86	17 24	56 - 44 15 29
12- 4-86	14 29	42 - 46 33 30
19- 4-86	12 13	37 - 34 31 18
26- 4-86	11 14	36 - 23 26 34
3- 5-86	10 47	43 - 16 26 1
10- 5-86	10 34	24 - 12 13 1
17- 5-86	10 27	42 - 9 32 15
24- 5-86	10 24	42 - 7 46 50
31- 5-86	10 23	56 - 6 36 49
7- 6-86	10 24	44 - 5 50 49
14- 6-86	10 26	32 - 5 21 55

NOTE: A copy of the listing and of a longer version of the program is available from the author for \$3.00 or send your own tape and \$1.00. Paul's address is POB 2034, Mesa, AZ 85204.

SHUTTLE DESIGNER

Software Review by
Duncan Teague



How appropriate it was to sit down in front of this program the day Shuttle Mission 51-D was launched. Senator Garn flew on 51-D, and so did Rhea Seddon, the only astronaut from my home town of Memphis ("Cosmic Rhea" we call her).

When I look at a new piece of software, my usual approach is to determine first how user-friendly the program is. If I can get satisfactory results from the program without relying on the documentation, then I judge it to be user-friendly. I have had to revise my definition of satisfactory results. Shuttle Designer is user-friendly, but my approach toward mastery of the program has been asymptotic.

"Satisfactory" means getting the rocket you design to put the assigned payload into a suborbital trajectory at the correct velocity before it runs out of fuel. If you succeed, then you are given an "access" code. The code is necessary to continue so that you can design a more complicated rocket. A second success gives you a final access code. You have graduated to the point at which you are qualified to design a Space Shuttle.

Help is available. First comes an elaborate tutorial on single and multistage rockets, liquid and solid fuels, principles of propulsion, payload considerations, and expected performance. Finally, you get to see the programs which accept user input to design a rocket based on the tutorial information.

A dozen or so graphic diagrams are displayed. If you have a printer, several charts summarizing characteristics can be printed out to save back-tracking or hand-copying important review information.

Your patience and perseverance are rewarded by being given opportunity to design your own rocket. You determine how much and what type of propellant to use, how fast the fuel consumption rate should be, and how large a rocket to use, to carry the fuel, crew, and payload.

SPACEWARE-SHUTTLE DESIGNER

J. A. Specialty Software
3103 Meadow Brook Trace
Birmingham, Alabama 35243
Timex/Sinclair 2068: \$27

If your design has a major flaw, a member of your project team lets you know. This courtesy saves you much embarrassment on the launch pad. If the design doesn't look too bad, you are invited to witness the launch.

A twenty-five second countdown begins. Sometimes it is interrupted to correct or analyze a last minute problem. Finally, the launch takes place. The rocket slowly rises



(actually, the launch tower slowly disappears off the bottom of the screen).

The view changes to an Earth chord, with the trajectory of your rocket traced above it. Readouts below the diagram show how rapidly the rocket is accelerating, and how much time has elapsed since ignition. From this point, you will see either the announcement that your rocket is out of fuel or that your design has been successful. You are shown the projected point of impact, successful or not.

Shuttle Designer helps the user appreciate the planning that has gone into the American space program. It has helped me realize that I can't absorb everything that must be known about rocketry in one hour. But just give me a few more days...

I thought some video games I've played were addictive! Shuttle Designer is no "space invaders" game. It is however, an absorbing educational tool for individual or classroom use.



ADVENTURES IN THE RAM JUNGLE AND OTHER MYSTERIES (PART TWO)

by Earl V. Dunnington

At the end of Part One of this article, published in the SEPTEMBER/OCTOBER issue, we emerged, unscathed by any "BUGS" from the upper RAM jungle onto the plateau of the safe area. We now descend into the lower RAM jungle where a giant bug lives, ready to devour the unwary. A map of the lower RAM jungle during its four major "Seasons" is illustrated in Figure No.1. Note the change in the "Landmarks" (addresses in the system variables) due to the expansion or contraction of the different areas during the different seasons. Just as all data below E_LINE is saved when recording the program on tape or other media, so must this data be saved whenever an area is expanded or contracted. This is done by actually moving the block of data that exists from the point of expansion or contraction to E_LINE (inclusive) moving it up or down in memory and writing over whatever existed in these addresses. All data in the system variables is adjusted to the new addresses.

Now that you have familiarized yourself with the map, I can proceed with some definitions. The minimum address to which you can actually set RAMTOP and the program will run, is the address of the top of the Calculator Stack (C Stack) during the execution of the program, plus the number of bytes in the combined GOSUB Stack (GS Stack) and Machine Stack (M Stack) during execution of the program, plus the 36 bytes of Spare Space required to avoid getting an "Out of Memory" error code. The number of bytes in the combined GS and M Stacks during the execution of the program is found by subtracting the upper limit of the safe area, determined, as we did in part one of this article, from the actual value of RAMTOP.

The lower limit of the safe (from the RUN command) area is the address+1 of the top of the C Stack during execution of the

program. The lower limit of the safe (from any other direct command) area is the address+1 of the top of the C Stack after the program execution, and upon entry of the direct command. You can see from the definition that the lower limit of the safe area is a floating value which depends upon what direct command will be entered into the computer after program execution.



Entering a direct command can have two effects on the C Stack. The first is to access work space which moves the C Stack up in memory. The second possible effect is to expand the C Stack. Can we determine how far a direct command moves the bottom of the C Stack? It should move the C Stack the same amount as there are bytes in the same command, entered as a program line, less four bytes containing the line number and the number of bytes in the command itself. To find the number of bytes in a direct command, enter it into the computer with a line number. Then enter the direct commands PRINT PEEK 16511 to find the low byte and PRINT PEEK 16512 to find the high byte of the length of the command. For example, enter the double PRINT PEEK n command with a line number:

```
10 PRINT PEEK 16410+256*PEEK 1  
6411
```

Peeking 16511 and then 16512 you should get 37 for an answer. Now enter the single PRINT PEEK n command with the same line number:

```
10 PRINT PEEK 16410
```

Peeking 16511 and 16512 you should get 14 for an answer.

The following portion of the article is for 3.25k or more of RAM. If you have less than that, just follow along until RAMTOP is poked to 18432 in the conclusion of this series of articles, as the results of the examples would be completely different. If you have more than 16k RAM, set RAMTOP to 32768 by poking 16388,0 and 16389,128. Then press NEW and ENTER.

Can we find the top of the C Stack during the program execution by inserting a line to peek the system variable STKEND? To find out enter the following lines into the computer:

```
10 FOR N=1 TO 48
20 NEXT N
30 PRINT PEEK 16412+256*PEEK 1
6413;" ";
```

Yes there is a space between the quotes. Now RUN the program. The value printed should be 17654. Enter NEW and let us try inserting the double peek line in the loop. Do not run ...save this program on tape, using SAVE "ONE".

```
10 FOR N=1 TO 48
20 PRINT PEEK 16412+256*PEEK 1
6413;" ";
30 NEXT N
```

I will call this Program One in the rest of the article. After saving the program, enter NEW, rewind the tape, load the program and enter RUN. The program will print the value

17654 on the screen forty-eight times. Since we will be doing things to the program that could change the location of the bottom of the M Stack, we must find the upper limit of the safe area first. Proceeding as we did in Part One of this article, peek the addresses under RAMTOP-50 and working down in memory until you find only zeros. This occurs at address 32715. Therefore the bottom of the M Stack is 32716 and the upper limit of the safe area is 32715 for this program.

If we peek STKEND using the direct double peek command:

```
PRINT PEEK 16412+256*PEEK 16413
```

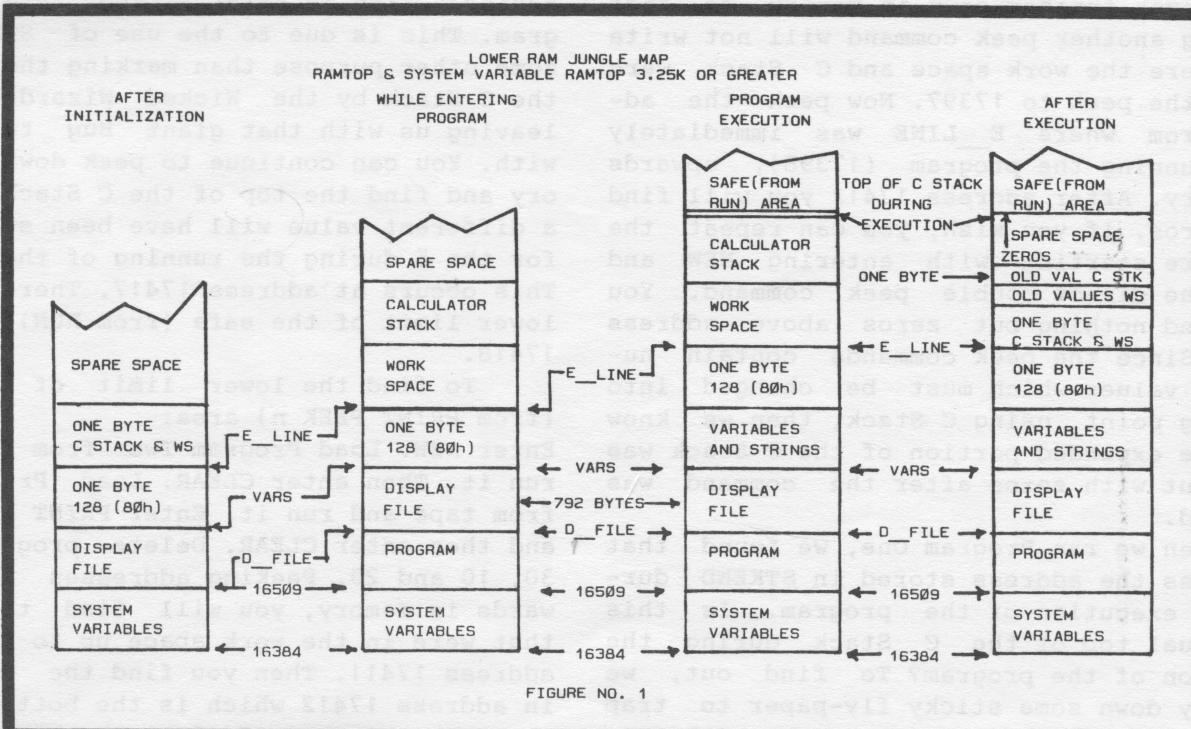
and then peek STKBOT (bottom of the C Stack) using the direct double peek command:

```
PRINT PEEK 16410+256*PEEK 16411
```

we get the same value, 17435. This is because the C Stack is collapsed by the ROM routines at the end of the program execution. But is 17435 the actual location of the bottom of the C Stack during program execution? To find out, change line 20 of Program One to read:

```
20 PRINT PEEK 16410+256*PEEK 1
6411;" ";
```

Now RUN the program and it will print the value 17398 on the screen forty-eight times. If you peek STKEND and STKBOT using direct double peek commands, you will again get 17435 which is a difference of 37 for the double peek commands. Now enter the following direct single peek commands:



```

PRINT PEEK 16410
this prints 4
PRINT PEEK 16411
this prints 68

```

and $4+256*68=17412$ which is the difference of 14 from 17398. You get these differences from the 17398 because a direct command will access work space, moving the collapsed C Stack up in memory by resetting the system variables STKBOT and STKEND. The expanding work space and expanding C Stack write over whatever was in the addresses above E_LINE. After the direct command has been executed, the C Stack is collapsed and moved back down to E_LINE merely by resetting the system variables of the C Stack to the address of E_LINE. The address immediately below E_LINE always contains the decimal value 128 (80h). The addresses occupied by the expanded C Stack are then cleared by placing zeros into them, precluding us from seeing where the top of the C Stack was during expansion. Referring to Figure No. 1, you can see the same thing happens to the spare space the expanded portion of the C Stack occupied during the execution of the program. Foiled by the Wicked Wizard of ROM.

For example, enter NEW, load and run Program One. Enter the immediate command:

```
PRINT PEEK 17397
```

you will get 128. Now enter CLEAR which will move E_LINE down by deleting the variable N. Delete the program lines 30, 10 and 20 which will move E_LINE (and the collapsed C Stack) even further down in memory, so that entering another peek command will not write over where the work space and C Stack were during the peek to 17397. Now peek the address from where E_LINE was immediately after running the program (17398), upwards in memory. After address 17412 you will find only zeros. If you wish, you can repeat the procedure starting with entering NEW and using the direct double peek command. You will find nothing but zeros above address 17435. Since the peek commands contain numerical values which must be changed into floating point, using C Stack, then we know that the expanded portion of the C Stack was wiped out with zeros after the command was executed.

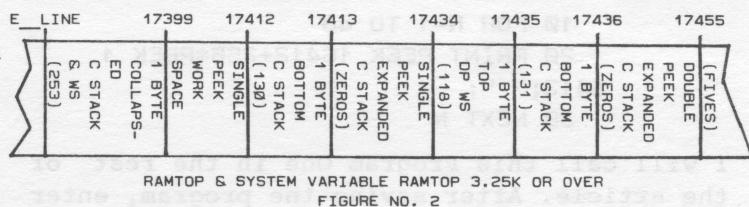
When we ran Program One, we found that 17654 was the address stored in STKEND during the execution of the program. Is this the actual top of the C Stack during the execution of the program? To find out, we must lay down some sticky fly-paper to trap the top of the C Stack. Press NEW and ENTER. Then type in the following:

```
10 FOR N=17398 TO 17654
```

```
20 POKE N,5
```

```
30 NEXT N
```

DO NOT RUN YET. Save this program on tape using SAVE "TWO". I will call this Program Two in the rest of this article. Run the program which will lay down the fly-paper consisting of a 5 in each address from 17398 to 17654. The fives will be changed to a different value when the C Stack expands during the execution of Program One or when they are written over by entering a direct command that moves and expands the C Stack above the address of the top of the C Stack during program execution. Enter CLEAR, load Program One from tape, and RUN. If you refer to the map (Figure No. 1), you will see that entering a program line also uses work space and expands the C Stack when numerical values are involved. This is why we put Program One on tape. Now enter CLEAR and delete lines 30, 10 and 20. Peek the address 17654 and the address immediately below 17654. As you can see, the fives have not been erased or changed. Therefore, we cannot determine



the address of the top of the C Stack by adding a line to print STKEND into a program. This is due to the use of STKEND for some other purpose than marking the top of the C Stack by the Wicked Wizard of ROM, leaving us with that giant Bug to contend with. You can continue to peek down in memory and find the top of the C Stack because a different value will have been substituted for the 5 during the running of the program. This occurs at address 17417. Therefore the lower limit of the safe (from RUN) area is 17418.

To find the lower limit of the safe (from PRINT PEEK n) area:

Enter NEW. Load Program Two from tape and run it. Then enter CLEAR. Load Program One from tape and run it. Enter PRINT PEEK 17397 and then enter CLEAR. Delete program lines 30, 10 and 20. Peeking addresses 17398 upwards in memory, you will find the values that were in the work space up to the 118 at address 17411. Then you find the value 130 in address 17412 which is the bottom byte of the C Stack. From 17413 to the top of the C

Stack at 17431 you will find only zeros. At address 17432 you will find the first five. You will find only fives in the address above that and on up to 17654. Therefore the lower limit of the safe (from PRINT PEEK n) is 17432. Proceeding in a similar manner, you will find that the lower limit of the safe (from PRINT PEEK 16412+256*PEEK 16413) area is 17455.

To prove when RAMTOP and the system variable RAMTOP are set to 3.25K or over:

1. The fives once written over are not transferred back again.

2. Only the addresses in the expanded portion of the C Stack are filled with zeros after the execution of a basic command.

3. The zeros are actually generated by the ROM routine.

Proceed as follows:

Enter NEW, load Program Two, and RUN

Enter CLEAR, load Program One and RUN

Enter PRINT PEEK 16412+256*PEEK 16413

Enter PRINT PEEK 17397

Enter Clear and delete program lines. Now peek addresses 17455 down to 17398. Your results should agree with Figure No. 2.

To calculate the address to which we can set RAMTOP for Program One:

The number of bytes in the combined GS and M Stacks is RAMTOP minus the upper limit of the safe area or $32768-32715=53$ bytes. The address of the top of the C Stack during the execution of the program was 17417. Adding the 53 bytes to 17417 we get 17470. As this is less than 19712, we can set RAMTOP to this value and the program will run. The reason you do not have to add 36 if RAMTOP will be set below 19712, is that a minimum display file is set up consisting of 25 enter codes. Even if the full 22 lines of the screen are used in the program, you would still have an extra 64 bytes available.

The lower limit of the safe area from the new command is 1+ the address to which we can lower RAMTOP and still have the program operate. Of course the system variable RAMTOP must have been poked to this address before executing NEW.

Normally, we want to find the absolute minimum address to which we can lower RAMTOP so that we will have the maximum storage space possible above RAMTOP. Among other mysteries, you will learn how to do this for Program One in the conclusion of this series of articles.



by Jeff and Stephen Brothers

[The following program and explanation was written for the T/S 1000/ZX81 with a 16k RAM pack.] This program computes interest over a certain period of time, at a selected interest rate. But what makes this program special is it's extensive input error checking at lines 90-120, 210-240, and 280-310. Using a string variable, the code of the input can be checked within specific parameters. The next line converts the value of the string to a numerical value. Where it is

then checked to see if it is greater than zero.

The sub-routine at lines 1000-1210 puts a dollar sign, commas, and decimal point in the proper places. Then it is centered. This routine was found in the "Timex/Sinclair 1000 Basic Handbook", by Douglas Hergert, published by Sybex.

At line 140, the amount is rounded to two decimal places should the input contain three numbers after the decimal point. At this point, the program GOSUBs to 1000. Line 1020 assigns the string version of T, supplied by the STR\$ function to the variable T\$. S\$ provides the form that the number should take, and accomplishes this using the "string slicing" technique. Lines 1030-1060 search for a decimal point. Line 1070 causes the program to branch if there are no cents. Lines 1080-1100 store the cents in S\$, as lines 1160-1170 store the dollars. Lines 1180-1200 leave the commas in S\$. After all

this manipulation, we jump back to the main program and use the print-centering routine in lines 460-470.

After printing the dollar amount, you get a choice: (1) do it again, or (2) stop (using a user-friendly INKEY\$ routine found at lines 550-650. To create the percent sign in line 340, use: SHIFTED GRAPHICS 2; SLASH; SHIFTED GRAPHICS 4. Lines 370 and 380 actually compute the interest. The rest of the program is to make it "friendly".

VARIABLES:

A\$/T & A-ORIGINAL AMOUNT

Y\$/N -YEARS

I\$/J & I-INTEREST

S\$/ -PRINT FORMAT

P\$/ -FORMATTED TOTAL

T / -TOTAL ACCRUED

K\$/ -INKEY\$

SP/ -FORMAT LENGTH

T\$/ -VALUE OF T

P / -DECIMAL POSITIONING

Z / -LOOP

N\$/ -DOLLARS TEST

```
00001 REM "INTEREST"
00005 REM BY JEFF AND STEPHEN BROTHERS
0010 SLOW
0020 SCROLL
0030 PRINT AT 21,7;"INTEREST ACCRUED"
0040 SCROLL
0050 PRINT
0060 SCROLL
0070 PRINT "ORIGINAL AMOUNT: "
0080 SCROLL
0090 INPUT A$
0100 IF CODE A$ <= 26 OR CODE A$ >= 38 THEN GOTO 90
0110 LET A= VAL A$
0120 IF A <= 0 THEN GOTO 90
0130 LET T=A
0140 LET T= INT (A*100+.5)/100
0150 GOSUB 1000
0160 LET P$=S$(SP TO LEN S$)
0170 PRINT AT 20,17;"$";P$
0180 SCROLL
0190 PRINT "NUMBER OF YEARS: "
0200 SCROLL
0210 INPUT Z$
0220 IF CODE Z$ <= 26 OR CODE Z$ >= 38 THEN GOTO 210
0230 LET N= VAL Z$
0240 IF N <= 0 THEN GOTO 210
0250 PRINT AT 20,17;N
0260 SCROLL
0270 PRINT "YEARLY INTEREST RATE: "
0280 INPUT J$
0290 IF CODE J$ <= 26 OR CODE J$ >= 38 THEN GOTO 280
0300 LET J= VAL J$
0310 IF J <= 0 OR J>100 THEN GOTO 280
0320 LET I=J/100
0330 SCROLL
0340 PRINT AT 20,22;J;" */"
0350 SCROLL
0360 PRINT AT 21,31; AT 21,0;
0370 LET T=A*(1+I) ** N
0380 LET T= INT (T*100+.5)/100
0390 IF N <> 1 THEN PRINT "AFTER ";N;" YEARS, YOU WILL HAVE:"
0400 IF N=1 THEN PRINT "AFTER ";N;" YEAR, YOU WILL HAVE:"
```

```
0410 SCROLL
0420 PRINT
0430 GOSUB 1000
0440 SCROLL
0450 PRINT AT 21,31; AT 21,0;
0460 LET P$=S$(SP TO LEN S$)
0470 PRINT TAB (1+ LEN S$- LEN P$);"$";P$
0480 SCROLL
0490 PRINT AT 21,31; AT 21,0;
0500 PRINT
0510 FOR A=0 TO 9
0520 SCROLL
0530 PRINT AT 21,31; AT 21,0;
0540 NEXT A
0550 PRINT AT 16,7;"(1)-AGAIN"
0560 PRINT AT 17,7;"(2)-STOP"
0570 PRINT AT 19,5;"PRESS DESIRED FUNCTION"
0580 IF INKEY$ ="" THEN GOTO 580
0590 LET K$= INKEY$
0600 IF K$ <> "1" AND K$ <> "2" THEN GOTO 580
0610 IF K$="1" THEN GOTO 630
0620 STOP
0630 FOR A=0 TO 21
0640 SCROLL
0650 NEXT A
0660 RUN
1000 LET S$="000,000,000.00"
1010 LET SP=12
1020 LET T$= STR$ T
1030 LET P=0
1040 FOR Z=1 TO LEN T$
1050 IF T$(Z)=".," THEN LET P=Z
1060 NEXT Z
1070 IF P=0 THEN GOTO 1150
1080 FOR Z=1 TO LEN T$-P
1090 IF Z <= 2 THEN LET S$(SP+Z)=T$(P+Z)
1100 NEXT Z
1110 LET N$=T$(1 TO P-1)
1120 IF N$ <> "" THEN GOTO 1160
1130 LET SP=SP-1
1140 GOTO 1210
1150 LET N$=T$
1160 FOR Z= LEN N$ TO 1 STEP -1
1170 LET SP=SP-1
1180 IF INT ((SP/4)*4)=SP THEN LET SP=SP-1
1190 LET S$(SP)=N$(Z)
1200 NEXT Z
1210 RETURN
9997 STOP
9998 SAVE "INTEREST"
9999 RUN
```

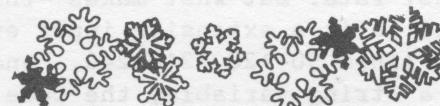
ECT.

TOO NEW TO CATEGORIZE:

* JRC Software (PO Box 448, Scottsburg, IN, 47170) has released a brand new game for the 2068 called DIAMOND MIKE. Has challenging plot, great graphics and sound! Price is: \$16.95.

* E. Arthur Brown Co. (3404 Pawnee Dr., Alexandria, MN, 56308) has brand new T/S catalog for the asking.

THE STAFF OF TIME DESIGNS
WHISHES YOU AND YOUR FAMILY
HAPPY HOLIDAYS!



AERCO FD-68 DISC DRIVE SYSTEM FOR THE 2068 PART 2

Reviewed by
Dennis Jurries

So far, Aerco has upgraded their EPROM to version .87. Only two features are not included at this date. They are the .CHR (Character Array) and the .DAT (Numeric Array). This means that you can't save and load string type data. Aerco is concentrating on their CP/M system at this time... rather than in completing their interface. They have released a new operating instruction booklet of 26 pages, which contains schematics, general information, and information on how to increase the bank switching capabilities to 256k. An improved booklet is still needed to show how to use the bank switching and .ARO functions. The [new] booklet also has some wrong information in it, concerning the requirement of saving the DOS program to each disc you use. I have found that that is not necessary.

First let's review the commands that are required to operate the various options of the disc drive...

FORMAT "", . . . used to record track and sector headers on a new disc.
MOVE "n.x", . . . to save programs to disc.

CAT "n.x", . . . to load programs from disc to the computer
ERASE "n.x", . . . to erase a program from the disc.

CAT "", . . . to look at the disc catalog menu.

n = the name of the program (1 to 10 letters and/or numbers)
x = extension as follows:

.ARO . . . refers to the DOCK BANK starting at 8000 Hex or 32768 Decimal
.BAS . . . refers to the basic program saved or loaded from disc. An optional decimal number can be included - the starting line number ie. MOVE "fun.BAS",9810
.BIN . . . refers to the machine code program saved or loaded from disc. ie. MOVE "fun2.BIN",56000,3010 It is in the same way as you would save and load from tape. ie. CAT "fun2.BIN", or CAT "fun2.BIN",40000
.BUT . . . refers to the system boot program and can be transferred to disc if desired.
.SCR . . . copies the screen display to disc and reloads it when required. (Similar to Screen\$)
.VAR . . . saves and loads all the basic variables without affecting the basic program. Should allow manipulation of the variables.
.LRO . . . runs in DOCK BANK starting at 0
.DAT . . . refers to numeric arrays. Similar to DATA in Basic and not available at this time.
.CHR . . . refers to character arrays. Used in saving and loading string data as in CHR \$. Not available at this time.



To make a BASIC program "auto-run" from disc as soon as the computer is turned on, call the name of the program BOOT and store it on as the first program of the disc (i.e. MOVE "boot.BAS",1 instead of MOVE "tasword,BAS",1). I have not to this date, been able to get the bank switching to work with the .LRO extension nor have I gotten anything out of the .VAR extension. If at sometime the disc system fails to work, type OUT 244,1.

One difficulty that we in our Users Group have found is that the disc drive IF will not work in conjunction with the A & J Microdrive. This is because both use Bit 5 of the I/O space to select the board. Aerco will modify their board to use Bit 4 instead if you wish.

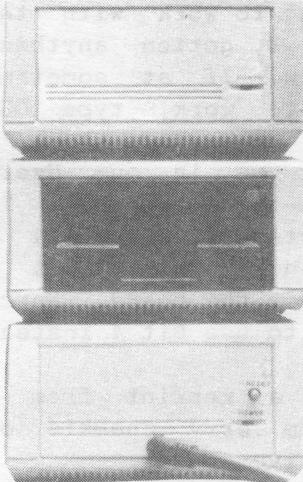
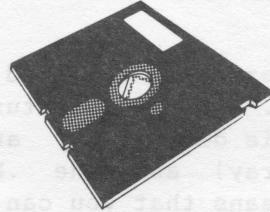
The following is a reprint from a letter written to me from Jerry Chamkis of Aerco concerning disc drive speeds:

"All disk interfaces that use a real disk controller (which is everybody except Compusa, Apple, Atari, and Commodore) transfer data to/from the disk at 250k bits/sec. This is not actually 32k bytes/sec as Ramex International claims, because not all of the disk bits are data bytes. About 20% of them are header information (where you are on the disk), CRC Data (= Cyclic Redundancy Check or error detection), and various house-keeping information the controller needs. So the fastest you can get the bytes into the system is maybe 25k/sec. +/- maybe 15% depending on how many sectors/track (lots of sectors = lots of headers). Now the question arises, what are you going to do with those bytes and how fast? In our system (AERCO), the fastest mode is .SCR. In that case, the first 2/3 of a screen are filled directly from the disk, then a 6Ms. interval to step to the next track, perhaps 1-50 Ms. to find the next header, the rest of the screen

moved to non-screen RAM and then block-moved in to the screen. I would guess the over-all transfer ranges from 10-20 kbytes/sec. depending on how you happen to catch the sectors in sequence. The slowest extension is probably .BAS. I really haven't done any measurements, but I would guess that it might range pretty close to what you mentioned, if you took into consideration that the first second of any disk operation is "dead time" waiting for the drive motor to reach operating speed (300 R.P.M.)."

The above was in response to [the table of] searching and loading times that I reported in the July/August issue of Time Designs Magazine.

You may be interested in looking in the COMPUTER SHOPPER magazine for your own disc drives and cases [if you are considering the Aerco interface]. They seem to list some of the best prices around. The Aerco FD-68 Disc Drive System is available from: AERCO, Box 18093, Austin, TX, 78760. Cost: for interface alone is \$199.00, for the complete unit (interface board, single drive, case and power supply) is \$400. I will report in upcoming issues of Time Designs on any further improvements to the disc drive interface.



ZEBRA DISK DRIVE SYSTEM FOR THE 2068

Review by
John Gaddis

In the beginning, there was the cassette. And as Timex began to tell people of their new powerful color computer, the only thing that stopped it from being compared to other computers in its class, was the lack of a fast mass storage system. But, people like myself bought this new computer anyway, because it was the natural progression from the ZX-81. And we waited for the mass storage devices that were promised. Well, I am here to tell you that the wait is over.

Unless you have been out of the country for the past year, I am sure that you have heard about the Timex Portugal Disk Drive System that was made in Europe and might be sold here in the United States. For a time, it seemed that this D.D. system would not be sold here. But thanks to some hard work by Zebra Systems Inc., the drives are here.

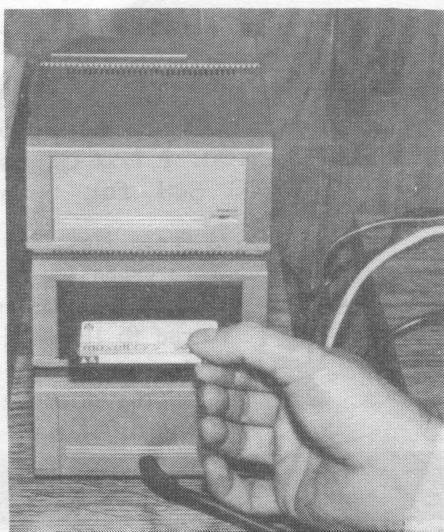
I received my drive about three weeks ago. The system itself comes in three

separate styrofoam boxes. Once you open these boxes you will find an interface that plugs into the back of the computer buss (with a Spectrum Buss Adapter or "Twister", which Zebra supplies), a D.D. Controller, a Power Supply, and the Disk Drive itself. Each unit is about 4.5"W x 2"H x 6"D. They are the same silver color that the 2068 computer is painted with.

Connecting the power supply to the controller and the disk drive, and the ribbon cable of the controller to the drive, is explained in detail in the system manual. The documentation that is supplied with the system is by far the best and most easiest to understand of any documentation I've seen for a Timex related product. The documentation and "ease of use" make this the best mass storage device on the market for the T/S 2068.

Once you have the system set up, the first thing that catches your eye, is the use of the 3 inch floppy disk. They are double-sided and double-density (although you can only write to one side at a time) and hold 360k of information. Also you will notice that the disks are much harder, and able to take abuse better than 5 1/4 inch floppies.

As soon as you get the system up and running, you will see a new copyright message along with the Sinclair and Timex messages. It will say "TOS 1985". Though it does not say it in the manual, this stands for Timex Operation System. Once I started to use it, I found it to be the most user friendly, and most powerful operating system



The 3" Hitachi-style diskettes are encased in plastic. There is also a spring loaded metal shutter that keeps finger prints off the disk's surface.

of any "under \$1000" computer on the market today...and believe me, I have used them all.

You will notice, if you use the PRINT FREE command that the operating system uses none of the computer's memory. That is because the TOS is in ROM in the controller. Not only does the controller have its own ROM, it also has its own Z80A C.P.U., as well as its own RAM. It is correct to say, that the D.D. system is a separate computer to the 2068.

As you start to use the drives, you will find that the only change you have to make in loading and saving files is to use a "*" after the command. Instead of LOAD and SAVE, it's LOAD * and SAVE *. After reading that one sentence, you can now convert and use most of the programs you now own. There is the CAT * command to display the disks contents, FORMAT * to prepare the disk for use, ERASE * to erase files on disk. As a matter of fact, all the commands that you used to look at with great curiosity at the top of the keyboard are now up to good use.

As the manual leads you step by step through the operating system, the ease of using this disk system becomes apparent. The TOS uses a "tree" structure that utilizes many directories on one disk. These directories are the "roots" that branch out to related files. The manual goes into this in detail in chapter 4.

The floppy disk [supplied with the drive] comes with some demo's and utilities that are worth noting. There are games and displays in the FUN directory. MATHS and FILING directories are good as well. It is the UTIL (or utilities) directory that is the most interesting. First, in order to take advantage of the two (yes two) RS-232C connectors on the back of the controller, there are programs to send and receive data

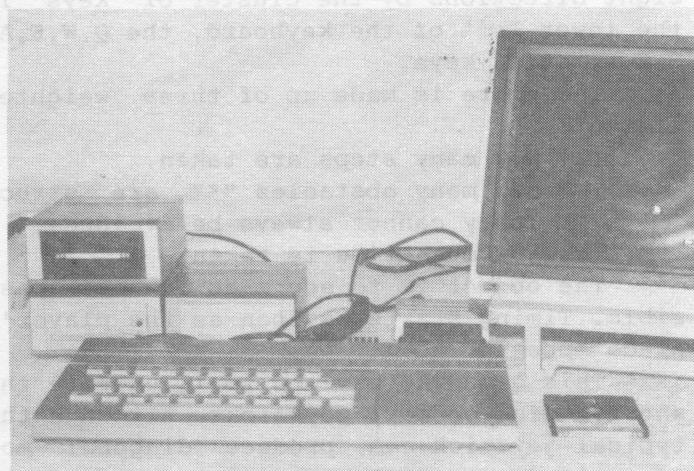
(via modem or direct hook-up), and a program to run a printer. A great program is one that will copy an entire disk to another disk as a back-up. Take my word for it that you will use this program often.

A description of everything this disk operating system can do would take much more room than I have here. There are methods of creating, erasing, protecting, copying and renaming files, as well as an extensive "help" file which will answer any question you may have.

Being a member of the Long Island Sinclair/Timex (L.I.S.T) group [in New York] as well as a person who uses computers at work, I have seen a lot of disk operating systems. I have yet to see one that offers so much to the user, including the systems that are out there now for the 2068.

There are some minor short-comings I have noticed. One is that the power supply runs a little too hot. Another is that there is no feed-through on the interface for you to connect other peripherals. On that last one though, Zebra Systems Inc. is in the process of making a "Super Twister" [or properly named Zebra Interface] that will have two feed-throughs, as well as an RGB connection and a [optional] Spectrum emulator. This twister will be ready soon.

I have no complaints at all about the way these drives operate. I now load TASWORD in seconds (in a little less than 7 seconds) instead of minutes. But I also have "random access". This allows me to write software that is not dependent on the computers memory. This is because you can use the D.D. to develop a "DISK RAM" system. What this does is it allows you to use the disk rather than the computers memory to store all your variables. In that way, you can have over 65,000 names in an address file!



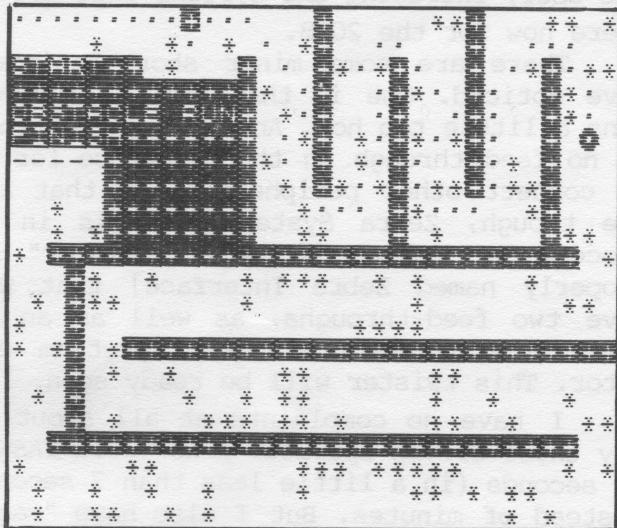
The Author's system (Zebra drives are far left).
The separate system components can be separated as in this photo, or stacked upright.

In summation, it took me a long time to decide which mass storage system I would buy. I feel that by waiting for the Portuguese [Timex] Disk Drives to become available, the wait was worth it. And what with rumors of C/PM compatibility on the horizon, there seems to be no limits to what our Timex/Sinclair 2068 can do. In my mind, the Zebra Floppy Disk Drive System was and is the best mass storage system, bar none.

If you should have any comments or criticism, please address them to: John Gaddis, 21 Regina Dr., Sayville, NY 11782.

[The Zebra Disk Drive System can be purchased from Zebra Systems, Inc., 78-06 Jamaica Ave., Woodhaven, NY 11421, (718) 296-2385. Price for the system is \$349.95. An additional drive is \$125.00. A box of ten disks is \$39.95. Add \$3.00 S&H for total order.]

At Press Time: The Zebra Expansion Interface that was referred to in the review was available and being shipped with D.D. Systems.



OBSTACLE RUN is a game for one player, or several players by comparing scores. The object is to move your piece, a heavy circle (that initially appears in the upper left corner of the screen), around the serpentine track, to the finish line, as quickly as possible. The piece can be moved in any of eight directions by the cluster of keys in the lower left of the keyboard, the Q,W,E,A, D,Z,X, and C keys.

The score is made up of three weighted elements:

- (a) How many steps are taken.
- (b) how many obstacles ** are struck (they cannot always be avoided).
- (c) How much time is taken.

The object is to score as low as possible. Timing starts as soon as the player's piece appears.

This game was devised to illustrate the short-coming of most joysticks. Although the typical joystick can produce diagonal motion, it does so only after a lag caused by moving vertically or horizontally first. This is because diagonal motion results from

2068

OBSTACLE RUN

by Warren Fricke



the closing of two of its internal electrical contacts, and they generally do not close simultaneously. Hence the usual joystick gives a vertical or horizontal step before moving the piece diagonally. In this game such a drawback can be disastrous as the game ends by disqualification if any of the barriers are struck, or if the piece goes out of bounds.

Why use diagonal steps? In this game it can mean a much lower score. One diagonal step counts less than a vertical step plus a horizontal step to reach the same block.

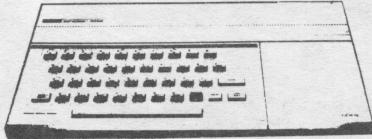
This program was written originally as a tutorial for my students in BASIC programming and it contains a number of fine points not normally treated in the manual. For example, the use of a FOR/NEXT loop, in line 80, to effect a delay instead of PAUSE. PAUSE cannot be used in this instance as the play is being timed and both of these functions use the same system address to record time.

Note also the order in which the movement of the player's piece is monitored. First to detect hitting an obstacle, in line 160. Then striking a barrier, in line 165.

Then going out of bounds, in line 170. And finally, reaching the finish, in line 175. The game can be speeded up by inserting the following:

```
158 IF SCREEN$ (r,c) = 32 THEN
    GOTO 200
```

In effect, this says that if the player's piece moved into a clear space, don't bother to check out anything else. Just count the



```
1 REM ** OBSTACLE RUN
@ by
Warren Fricke
2
5 RANDOMIZE
15 GO TO 200
20 GO TO 700
30 LET r=0: LET t=0
40 LET t=1: LET w=0
50 BEEP .05,2: BEEP .05,9: BEE
P .06,20
60 POKE 23673,0: POKE 23672,0
70 PRINT AT r,c;CHR$ 145
80 FOR i=1 TO 10: NEXT i
90 LET r=r: LET c=c
110 LET s=PEEK 23556
150 LET r=r+(s=67 OR s=88 OR s=
90)-(s=69 OR s=87 OR s=81)
155 LET c=c+(s=67 OR s=68 OR s=
69)-(s=65 OR s=81 OR s=90)
160 IF SCREEN$ (r,c)=CHR$ 42 TH
EN GO TO 300
165 IF SCREEN$ (r,c)=CHR$ 43 TH
EN GO TO 400
170 IF r>21 OR r<0 OR c>31 OR c
<0 THEN GO TO 500
175 IF SCREEN$ (r,c)=CHR$ 45 TH
EN GO TO 600
200 PRINT AT rr,cc;CHR$ 145 AND
(rr<>r OR cc<>c)
240 LET t=t+1
250 GO TO 70
300 PRINT AT rr,cc;CHR$ 145
305 BEEP 1,10: LET w=w+1
310 FOR n=1 TO 5
315 PRINT AT 7,7;"HIT": FOR i=1
TO 2: NEXT i: PRINT AT 7,7;""
320 NEXT n
330 GO TO 70
```

step. For those of you who would like to use the same obstacle pattern each time, and thus the same road conditions for several players, add a value to the randomize line, say

```
5 RANDOMIZE 10
```

Any integer number from 1 to about 65535 should be OK.

```
400 PRINT AT rr,cc;CHR$ 145
405 BEEP 2,-25: PRINT AT 6,6;""
;AT 7,6;"":FLASH 1
;AT 8,6;"":FLASH 1
408 PRINT AT r,c;CHR$ 144
410 PAUSE 120
420 PRINT AT 18,3; FLASH 1;"FEE
;AT 18,2;FLASH 1;""
430 INPUT z$: CLS : RUN 800
500 BEEP 1,-20: BEEP 2,-35
505 PRINT AT 5,7;"":FLASH 1
;AT 7,7;"":FLASH 1;AT 8,6;"":FLASH
;AT 9,7;"":FLASH 1
510 GO TO 410
600 PRINT AT rr,cc;CHR$ 145
605 LET a=PEEK 23672+256*PEEK 2
3673
610 PRINT AT r,c;CHR$ 144
620 BEEP .05,2: BEEP .05,9: BEE
P .06,20
630 PRINT AT 6,7;"":FLASH 1
;AT 7,7;"":FLASH 1;AT 8,8;"":FLASH
;AT 9,8;"":FLASH 1;INT (a/60+t+10*w)
640 GO TO 410
700 BORDER 1
705 PRINT AT 6,9;"OBSTACLE PWN"
;AT 7,10;"":NEXT n
710 PRINT AT 10,2;"The background
takes 10 to 15 seconds to ge
nerate and print."
720 PRINT AT 12,3;"Stand by,---"
and---
730 PRINT AT 14,5;"be ready to"
750 PRINT AT 14,17; FLASH 1;""
;AT 15,17;"":FLASH 1;""
760 PAUSE 480: CLS
800 BORDER 1
815 FOR n=1 TO 704
820 LET q=RND .
825 PRINT INK 2; ("*" AND q>.75)
+(" " AND q<=.75);
830 NEXT n
840 PRINT AT 0,0;""
;AT 1,1;"":NEXT n
845 PRINT AT 3,0;"-----"
;AT 4,0;"":NEXT n
850 FOR n=2 TO 29
855 PRINT AT 10,n;"":AT 18,n;""
;AT 19,n;"":NEXT n
```

SOFTWARE

A TOUCH OF GREY ZPRINT-80

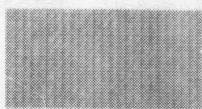
Review by
Michael E. Carver

If you own a full-size dot matrix printer and a Centronics interface, you can now produce full-page graphic screen dumps. You will also be able to faithfully reproduce your color artwork in shades of gray, thanks to Zebra Systems Inc. "ZPRINT-80".

Zprint-80 is a printer support package for the T/S 2068 and Spectrum computers, which will reproduce full-page gray-scale

dumps of color screens. I received an advance copy of this software (version 1.2) to test with my Aerco printer interface and a Mannesmann Tally Spirit-80 printer. This review will be based only on this configuration. I was informed by Zebra that there were a few bugs discovered in this edition and that they were corrected before shipment of any orders. They also stated that if any more problems occur, they will gladly replace any faulty software with a corrected update. If only other software companies felt this responsibility to their customers! (Note: See insert for the interfaces and printers supported by package)

The cassette contains a Timex version on one side and a Spectrum version on the

**BLACK****BLUE****RED****MAGENTA****GREEN****CYAN****YELLOW****WHITE**

ZPRINT-80's grey scale representing eight colors. Picture to the right was "painted" by the Author using the new Spectrum program, "The Artist". It was printed on a full sheet using ZPRINT-80 (with "custom" changes), then reduced photographically.



flip side. I had no trouble loading either side the first time. The program loads in two parts. The first will prompt you for the address to place the driver program (all machine code). It may be placed at either 64000 or 27000. The latter is specifically designed for use with programs such as Zeus Assembler/Disassembler. Instructions are provided in the manual on merging Zprint with Zeus and your own programs. The main code is then loaded. Next you are to choose the brand of printer to be driven and through which interface, width (a max. of 136 characters), and whether a line feed needs to be sent to your printer. The program will then save this "customized" version to tape for future use.

Two types of screen dumps are available through Zprint. Both are accessed by RANDOMIZE USR calls. The printer is put into dual-density graphic mode for these dumps and then reset to power-up state after completion. The first is equal to the copy routine and dumps sent to the T/S 2040 printer. The size is the same and only set pixels (ink) are printed. Normally, this dump is printed in the center of the paper, but any column may be chosen for the left-hand margin. The second will produce a large scale picture on an 8 1/2 x 11 sheet of paper, reproducing all colors, ink or paper, in shades of gray. This program will not produce different shades for BRIGHT (see example). This picture is printed sideways on the paper. In both versions, all 24 lines of the screen are printed. The graduation of color-scale is very good; however, on my Spirit 80 the proportions of the pictures were distorted. The full page picture was stretched out on the sides, and small blank lines were visible between each line of print. I was able to compensate for this by

changing the program's line spacing command. The normal screen dump was compressed length-ways. Again I was able to compensate by changing the size of line spacing in the code. Hopefully, these will be fixed in the new version. (NOTE: Aerco's copy routine is totally inadequate for graphic dumps. Large blank lines were left between each line. I had to write a machine code patch in order to obtain a decent graphic screen dump. Aerco never responded to my inquiry on how to remedy this problem.) Painting a full-page masterpiece is not quick, but Zebra claims that their's is faster than Tascopy (Zprint-80 in 5 min. vs. Tascopy's 9 min.).

Zprint is also a full-size printer driver, supporting both LPRINT and LLIST. (NOTE: Upon loading Zprint, the contents of my first LPRINT was never sent to the printer. Zebra assured me that this problem has been fixed.) I find that Zprint is easier to use and more dependable than the driver I received with my Aerco interface. Zprint works in tandem with the 2040 printer routines contained in ROM. This should allow Zprint to be compatible with more software than some other drivers. I can even use Zprint with Vu-File, if I leave at least 1500 bytes unused in the data file. There is no need to POKE addresses before choosing LLIST or LPRINT when using Zprint. I am embarrassed to tell how many sheets of paper I have wasted with Aerco's software, because I forgot one precious POKE before attempting a listing. You can easily toggle back and forth between full-size and 2040 printer by RANDOMIZE USR commands. With Zprint, if your printer goes off-line (out of paper, error, dog bit through power cord) Zprint will not fail or break-out into BASIC. Once you have fixed the printer's problem and switch on

line, printing will continue where it left off. Aerco's software would break into BASIC and at times be unable to continue printing after the printer was brought back up. LLIST'ings produced with Zprint are consistent with the screen and the 2040 printer, if width is set to 32 (this is changed by POKE'ing (base + 12), width: RANDOMIZE USR (base)). Even when my Aerco software was set at 32 characters, my listings still did not correspond with the screen in spacing.

I feel that Zprint has done an excellent job in cramming so much into a small package (1300 bytes compared to Aerco's 1111 bytes). If you are looking for a means to make enlarged color graphic screen dumps or an improved printer driver, give Zprint a try. (NOTE: I would like to state, that my recommendation is based on past experience with Zebra and their fast response to problems. Also, that they appear sincere about

either, delivering a product that will perform, or gladly refunding your money, if they cannot correct the problem.) You may order a copy from Zebra Systems Inc., 78-06 Jamaica Ave., Woodhaven, NY 11421, (718) 296-2385. Price is \$19.95 + \$3.00 (standard shipping and handling charge).

ZPRINT-80 SUPPORTED INTERFACES & PRINTERS

Interfaces

Aerco
Tasman-B
Tasman-C
A & J

Printers

Gemini 10X
Gemini SG10
Memotech DMX80
Panasonic 1090/1091
Epson RX/FX
Mannesmann Tally Spirit-80
Prowriter 8510

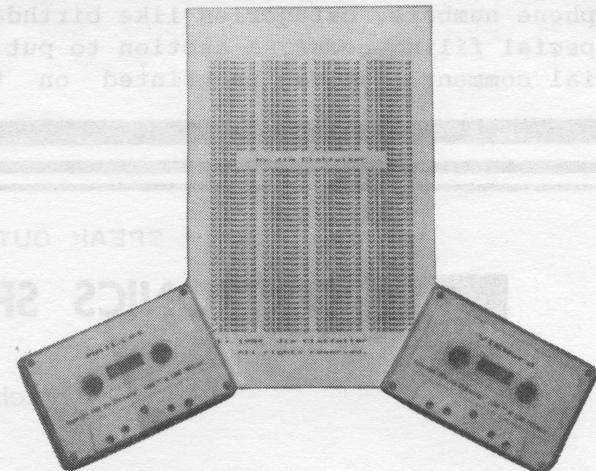
VIEWORD MAILIST FORMAIL

Reviewed by
Tim Woods

Several months ago I received a three-piece software "package" for review from Jim Clatfelter (3361 Sand Ridge Rd., Placerville, CA 95667). VIEWord, MAIList, and FORMail are for the T/S 2068, and the three title package is priced at \$25 (postage included). My reason for the delay in writing this software review, is that I wanted to really put these programs to use and get to know their features, instead of just jotting down a few comments from a hasty evaluation.

VIEWord, MAIList, and FORMail are utility programs that would be most suited for the small business environment or personal home computing. VIEWord is an interesting (but easy-to-use) word processor. MAIList, as the name implies, is an address manager, and FORMail is a utility that uses files from both VIEWord and MAIList, to print formal type letters. My initial impression of this package, is the over-all professional appearance it has. Not just the labeling or instruction sheets, but in the programs themselves. Obviously Mr. Clatfelter has spent a good deal of time in developing and programming them.

To give you a little background, the



programs are mainly written in BASIC, except for a print-driver routine. Output can be sent to either the T/S 2040 printer, or to a full size printer using the Aerco Centronics interface (the bytes for the Aerco interface have already been programmed in). I feel that it would be quite easy to customize the programs for your own printer interface such as the Tasman.

One very striking feature of this software package, is that it is "integrated". A feature found on much costlier software for computers like IBM PC. In other words, commands and procedures found on one program would operate exactly the same in the other programs. Once you have learned VIEWord (for example), working with MAIList is a breeze.

As a word processor, VIEWord is much simpler to use (for first time users), than say MSCRIPT. Yet it is much more sophisti-

cated than some of those "what you type is what you get" word processors. You can set your line-length to either 32 or 64 col. To use the extensive editing features from the menu, just enter a key-letter on the first command line. Going back and fixing up a mistake later on is handled differently than on most word processors. You indicate what the mistake is, retype what should be there and the computer compares the two and inserts the new information. The user never operates the cursor or delete key in this operation. Other features include: block cut and paste, tabs, centering, page numbering, embedded printer control codes, and a type of word-wrapping. The only two complaints that I have are, it would be nice if the word wrap feature was automatic, and there is no right column justification.

MAIList is a real gem. I have seen the gamut of address managers for 2068 and Spectrum computers. None of them are as comprehensive as this one. Along with the normal data entry, there is also record keeping of telephone numbers, catagories like birthdays or special filing codes, a section to put a special comment that can be printed on the

label, or not if the user so desires. You can save a total of 200 addresses in one file. Printing can be done on "one-across" label sheets, or a "master list" on fan-fold paper. A label file can be ordered by zip code, last name, or phone number. The time it took to order a full file was about two minutes. All of the extensive editing and searching features that VIEWord has, are in MAIList also.

VIEWord and MAIList files can be loaded into FORMail, and then other information can be introduced like a header date and a salutation. Then it is all sent to a printer which makes a nice note with custom name and address on each letter.

Although the programs were in BASIC, they operated faster than I expected. Being in BASIC also allows for customizing to suit a particular need.

I think that you would find this software package to be versatile and comfortable to work with. At \$25, that is only \$8.33 per program...a very good deal. If you do happen to take Mr. Clatfelter up on this "deal", I think that you would be suprised at how much you get...as I was.

SPEAK OUT AND BE COUNTED

D'KTRONICS SPEECH SYNTHESIZER

Review by
Michael E. Carver

You have your computer hooked up to your CRT, your line printer plugged in, and the computer is emitting beeps or, perhaps, even music, but...if only it could speak. Oh, the stories it would tell. Thanks to Dk'tronics, your computer can keep you up all night with amazing tales.

Dk'tronics Speech Synthesizer for the Sinclair Spectrum is available in the U.S. from DAMCO. If you have a T/S 2068 and a "twister" allowing Spectrum hardware to be plugged onto your edge connector, Dk'tronics synthesizer can make your computer speak up. The voice produced is mechanical, more like a Buck Rogers robot or a Dalek (for you Dr. Who fans), and not lyrical or as human as HAL's in 2001: A Space Odyssey.

This package consists of hardware and software. Included is an interface containing the synthesizer and an amplifier,

plus an external 4-inch speaker. The interface is 4" x 2 1/4" x 3/4" and is enclosed in a black plastic case with full through-buss connector out the rear. The interface case also has a volume control knob and a standard earphone jack for hooking the interface to the speaker, or an audio system/tape recorder.

The brain (or voice) of this interface is General Instrument's SP-256 synthesizer, which contains an allophone library in ROM. There are 59 different speech patterns (or allophones) and 5 set pauses stored in this library. Words are created by combining these allophones into specified patterns (see table 1).

The synthesizer can be operated in four different modes. The first requires no special software. The interface is accessed through BASIC, using the OUT command to send

an allophone code to port 127 (see listing 1).

To use the remaining modes, the accompanying software must be loaded. This software is approximately 4.7k of machine code and can be located anywhere in RAM. The positioning of this software is done by the loading routine, after specifying the desired location. The second mode is similar to the first in that you must look up each allophone, but is sent to the synthesizer in an LPRINT statement (see listing 2).

Modes three and four are the easiest to use as they are text-to-speech modes. About 3.5k of the program contains a table of English rules along with some of the many exceptions (see listing 3 & 4). Modes 3 and 4 are "interrupt driven", returning control back to the computer while the synthesizer continues to speak. Mode three's text buffer will only hold 100 characters. Any LPRINT statement with more than 100 characters will be truncated, losing extra text. I was unable to cause any lost text in mode four.

Since there are more exceptions than rules in the English language, at times it will be necessary to misspell a word to achieve a recognizable pronunciation, (i.e. silicon = silickon). It is not possible to produce inflection patterns with this synthesizer, but there are sixteen speeds for speech output. There are a few "bugs" in this part of the software which cause some awkward pronunciations. The text-to-speech software changes the "ahh" sound to "or", giving the computer a strange Bostonian accent. Also, the "a" in such words as "cat" is pronounced like "caught". It is sometimes necessary to combine the "feed" feature with either modes three or four to produce acceptable speech. (NOTE: Modes 1-3 will work with your computer in Timex ROM select)

The manual, accompanying the unit, is very helpful in getting one started. There is a section on accessing the software via calls to its various routines, to help those who enjoy writing machine code. Anyone should be able to teach their computer to speak with this unit, by simply following the easy steps laid out in the manual.

If you are interested in speech synthesis and will settle for a "mechanical voice", I feel that Dk'tronics unit is a good buy for the price. It was very easy for me to add speech to a BASIC Star Trek game, with only minor changes to PRINT commands. With a little effort, a talking machine could be constructed for those with physical disabilities.

You can order your unit from DAMCO ENTERPRISES, 67 Bradley Ct., Fall River, MA 02720, phone (617) 678-2110, for \$34.95 + \$2.50 S & H. (For you Dr. Who fans, your computer can now faithfully reproduce that spine-chilling word "EXTERMINATE"!)

```
10 REM Listing 1 - Will output  
"Time Designs"  
20 FOR x=1 TO 13  
30 IF IN 127<>127 THEN GO TO  
30: REM wait for chip ready sign  
al  
40 READ a: OUT 127,a: NEXT x:  
STOP  
50 DATA 13,24,6,16,2,33,19,2,4  
3,6,44,55,0
```

```
10 REM Listing 2 - Will output  
"computer"  
20 LPRINT ":feed,42,15,16,9,49  
.22,13.51"
```

```
10 REM Listing 3
20 LPRINT "!spon": REM turns on speech to text
30 LPRINT "\Welcome to the machine"
```

```

10 REM Listing 4: REM will speak any LPRINT statement or even
LLIST - does not require "\\" (backslash) to signal speech to text
software
20 LPRINT "loutm,2": REM turns on mode four
30 LPRINT "Timex Sinclair"
40 INPUT a$: LPRINT a$: REM Will output user's INPUT to synthesizer
50 LLIST : REM Will "speak" line

```

ALLOPHONE TABLE

Pauses			Resonants				
0	PA1	(10 mS)	use before voiced stops & affricates	14	RR1	R	read
1	PA2	(30 mS)	use before voiced stops & affricates	39	RR2	R	brain
2	PA3	(50 mS)	before voiceless stops & voiced fricatives	49	YY1	U	computer
3	PA4	(100mS)	between clauses & sentences	25	YY2	Y	yes
4	PA5	(200mS)	between clauses & sentences	45	LL	L	luck
5	Short vowels - can be repeated			46	WW	W	wool
Voiced Fricatives							
7	EH	E	bend	18	DH1	TH	they
12	IH	I	fitting	54	DH2	TH	bathes
15	AX	U	succeed	35	VV	V	even
23	AO	AU	augh	42	ZZ	Z	zoo
24	AA	O	cot	38	ZH	GE	belge
26	AE	A	fat				
30	UH	OO	cock				
Voiceless Fricatives							
23	AO	AU	augh	29	TH	TH	thin
24	AA	O	cot	40	FF	F	fire
26	AE	A	fat	55	SS	S	sat
30	UH	OO	cock	(29, 40, 55, double for initial position)			
Long vowels							
5	DY	DY	toy	27	HMH1	H	he
6	AY	Y	sky	57	HMH2	H	hoe
19	IY	E	see	37	SH	SH	shirt
20	EY	EA	great	48	WH	WH	whig
Voiced Stops							
22	UW1	O	to				
31	UW2	OO	food	28	BB1	B	rib
32	AW	OU	out	63	BB2	B	big
53	DW	OW	snow	21	DD1	D	could
62	EL	L	angle	33	DD2	D	do
				36	GG1	GU	guest
Voiced Stop							
				61	GG2	G	go
				34	GG3	IG	wig
R-Colored vowels							
47	XR	AI	hair				
51	ER	ER	computer				
52	ER2	IR	bird				
58	DR	OR	store	17	TT1	T	its
59	AR	AR	farm	13	TT2	T	to
60	YR	R	clear	42	KK1	C	computer
				41	KK2	K	sky
Affricates							
10	JH	J	jury	9	PP	P	pub
50	CH	CH	church				
Nasal							
				16	MM	M	milk
				11	NN1	N	earn
				56	NN2	N	no
				44	NG	NG	bans



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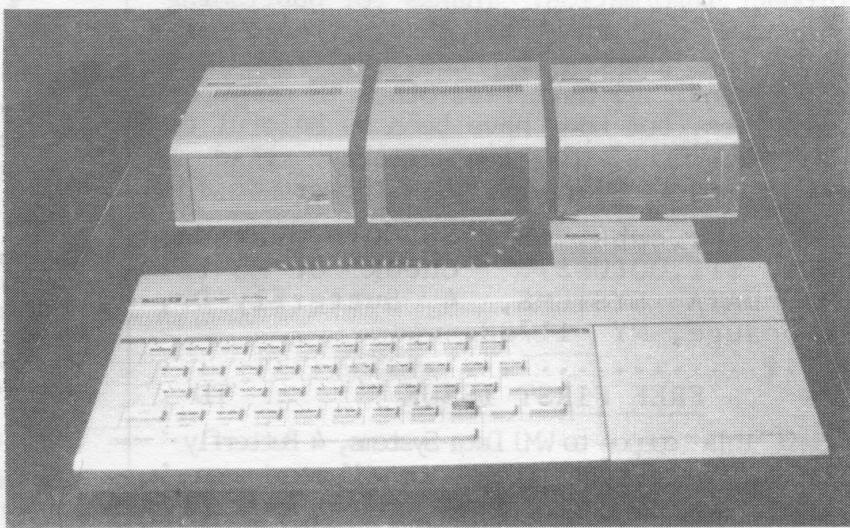
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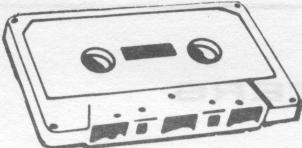
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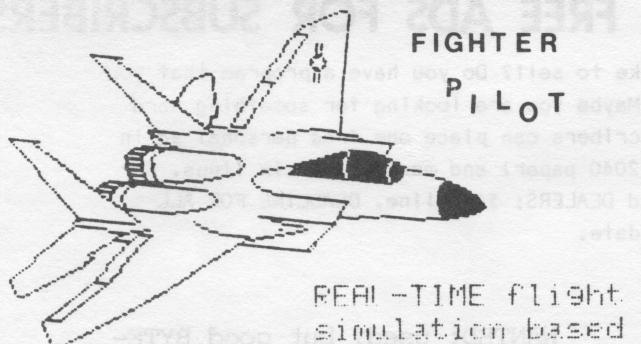
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